

REMARKS

At the time the Office Action was mailed, claims 1 – 6 were pending.

Claim Objections

Attorney has amended claim 1 as requested. With regard to claim 2, the change suggested by the Examiner would add an additional structure upon which the coating is applied. Attorney respectfully submits that claim 2 is directed to providing the marine element itself with a coating with the required k/D ratio. The changes suggested by the Examiner would have interposed yet another structure. Attorney respectfully declines to adopt the change but has amended claim 2 to call for the step of providing a coating. With regard to claim 3, it has been amended to claim providing an ultra-smooth surface on a substantially cylindrical sleeve about the cylindrical element, the sleeve having the required K/D ratio. Attorney respectfully submits that the amendment suggested by the Examiner would have resulted in the claim being less than clear. With regard to the requested change with respect to claim 4, line 6, Attorney is at a loss as to the amendment requested by the Examiner, as claim 4 is directed to the marine element itself having an ultra-smooth surface. Claim 5 achieves the ultra-smooth surface by way of coating, while claim 6 utilizes an ultrasmooth sleeve. The suggested change to claim 4 would not make sense in this context.

Rejection of Claims 1 – 6 Under 35 U.S.C. §112 ¶1

In Paragraph 6 of the Office Action, the Examiner rejects claims 1 – 6 under 35 U.S.C. §112, first paragraph as failing to comply with the enabling requirement. It is asserted that the claims contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Specifically it is asserted that the Declaration of Donald W. Allen (Allen Declaration 1), paragraph 13, teaches that a cylinder with a k/D in the range of 1.21 – 1.51 E-4, without strongback, had increased VIV and increased drag. Further, the smooth PVC cylinder with a k/D ratio in the range of 0.886 – 1.09 E-4 without a strongback also displayed substantial vibration and increased drag.

The Examiner states that there is no additional limitation in the pending claims to explain why the same structure that is specifically noted as not reducing/controlling drag and VIV can be used to successfully reduce/control drag and VIV. It is stated that either there is an enabling step or feature missing, or the claimed invention cannot work.

Attorney has consulted with Dr. Allen regarding why the same purported k/D ratios in the 1995 tests and the 1997 that support the claimed invention resulted in differing outcomes. Attorney is submitting a second declaration of Dr. Allen (Allen Declaration 2) with this response. The details for selection of the ABS and PVC cylinders and the methods used to determine the smoothness are set forth in Allen Declaration 2, paragraphs 7 – 10. It should be noted that no special surface preparation was used. See, Allen Declaration 1, paragraph 11. In contrast, the fiberglass cylinder used for tests conducted in 1997, which are the basis for the present application, under went a grinding process that ensured uniform cross section and smoothness. See, Allen Declaration 1, paragraph 11; Allen Declaration 2, paragraph 12. This resulted in lower R_a and k/D values for the fiberglass cylinder. Allen Declaration 2, paragraphs 9 – 14.

The crux of the Examiner's rejection is that the average k/D for the PVC and ABS cylinders falls within the claimed range, but failed to exhibit the VIV performance claimed in the present application. Dr. Allen believes that the differences are attributable (a) the selection and preparation of the cylinders, and (b) the ovality and the lower modulus of elasticity for the ABS and PVC cylinders. See, Allen Declaration 2, paragraphs 18 and 19.

In particular, while samples from the PVC and ABS cylinders exhibited the R_a and k/D ratios, it is believed that they were not representative of the overall smoothness of the cylinders. The PVC and ABS cylinders were purchased commercially with no specific surface preparation other than being wiped with acetone. Allen Declaration 1, paragraph 11. The fiberglass cylinders used in the present application were custom manufactured. The smooth cylinders used in the tests were ground to achieve a uniform surface smoothness. This smoothness was uniform across the entire length of the pipe. While the samples for the PVC and ABS pipes were in the claimed range, it was unlikely that the smoothness was uniform across the entire length. Allen Declaration 2, paragraphs 17 – 20.

The method of manufacture could likewise have had another effect. As Dr. Allen notes in his declaration, the PVC and ABS cylinders were extruded. This could result in an increased ovality, i.e., variation in the circular cross-section of the cylinders. A variation in cross-section would result in varying flow across the cylinders which could contribute to VIV. Further, the material itself could have contributed to the increased VIV. The PVC and ABS cylinders had a modulus of elasticity of 457 ksi and 220 ksi, respectively. The fiberglass cylinder exhibited a modulus of 2,000 ksi in bending and 2,200 ksi in tension. The fiberglass cylinders were less likely to deform under flow conditions. Deformation of the cross section of the PVC and ABS could have also resulted in the exhibited vibration and drag. Allen Declaration 2, paragraphs 18 – 20.

While the samples for the PVC and ABS cylinders exhibited a k/D ratio within the same range, there were a number of factors that resulted in their failure to exhibit VIV and drag suppression. The tests described in the specification did not suffer from these same factors and resulted in superior VIV and drag suppression. Accordingly, the claims are enabled in that the specification calls for a surface having the claimed k/D range that have been shown to exhibit VIV and drag suppression.

Rejection of Claims 1 – 6 for Double Patenting

In paragraphs 8 – 13 of the Office Action, the Examiner rejects claims 1 – 6 under the judicially created double patenting rejection with respect to US Patent 6571878 and other references. Attorney is concurrently submitting a terminal disclaimer to address this basis for rejection. Comments with respect to specific bases for rejection follow below.

a. Claims 1 – 2 and 4 – 5

In paragraph 9 of the Office Action, the Examiner rejects claims 1 – 2 and 4 – 5 as being unpatentable over claims 1 and 3 of US Patent 6571878. Attorney respectfully submits that the terminal disclaimer filed with this response fully addresses the basis for this rejection.

b. Claims 3 and 6

In paragraph 10 of the Office Action the Examiner rejects claims 3 and 6 under the doctrine of obvious-type double patenting as being unpatentable over claims 1 and 3 of US Patent 6571878 in view of US Patent 4470722 to Gregory. It is stated that Gregory teaches that fairings are commonly known to suppress VIV of a single riser and that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified US Patent 6571878 to include smooth surfaces of $1E-4$ or less as taught in the patent, as a sleeve on a substantially cylindrical element.

While the terminal disclaimer should address any issues relating to US Patent 6571878, the Examiner is in error in equating the VIV suppression capabilities of the present invention with that of a fairing. One of ordinary skill in the art in the field of VIV suppression would know that a fairing is not generally cylindrical in that, while one portion of the fairing is semi-cylindrical, it terminates in a taper or fin, much like an aircraft wing or a weather vane. See, e.g., <http://www.mms.gov/tarprojects/485/Session1FundamentalsofVIV-Dalton.pdf>, at page 29. There is nothing that would suggest that a fairing could be equated to the cylindrical body of the claimed invention.

c. Claims 1, 3, 4, and 6

In paragraph 11 of the Office Action, the Examiner rejects claims 1, 3, 4, and 6 under the doctrine of obviousness-type double patenting as being unpatentable over claim 1 of US Patent 6702026. It is stated that although the conflicting claims are not identical, they are not patentably distinct as US Patent 6702026 teaches a substantially cylindrical maritime element with a k/D of 1E-5 or less, with the surface comprising a sleeve and no other structure. It is stated that the only method step disclosed is providing the structure and the method is inevitably taught by the structure. Attorney has filed a terminal disclaimer which addresses this issue with respect to both US 6571878 and US 6702026.

d. Claims 2 and 5

In paragraph 12 of the Office Action, the Examiner rejects claims 2 and 5 under the doctrine of obviousness-type double patenting as being unpatentable over claim 1 of US 6702026 in view of Gregory US 4470722. It is stated that US 6702026 discloses a substantially cylindrical marine element with a k/D ratio of 1E-5 or less, with the surface comprising a sleeve with no other structure disclosed. It is stated that Gregory teaches a cylindrical housing element for use with a marine production facility that has an exterior coating of fiberglass or plastic. A sleeve is posited to be an obvious variant of a coating or cylindrical surface. It is further posited that fairings are known to suppress VIV and that it would have been obvious to one of ordinary skill in the art to provide the smooth surfaces disclosed in US 6702026 as a coating on a substantially cylindrical element, as taught by Gregory, in order to minimize the additional costs and labor required in providing an ultrasmooth surface.

Attorney respectfully submits that the Terminal Disclaimer filed in this case addresses the issue of obviousness-type double patenting. However, the argument posited by the Examiner contemplates providing an ultrasmooth surface on a sleeve as taught by Gregory. Attorney respectfully submits that providing a coating directly on the marine element is not rendered obvious by providing said coating on a sleeve.

Rejection of Claims 1 – 6 Under 35 U.S.C. §103

In paragraphs 13 – 15 of the Office Action, the Examiner rejects claims 1 – 6 as being obvious over D. Allen, D. Henning, *Vortex-Induced Vibration Tests of a Flexible Smooth Cylinder at Supercritical Reynolds Numbers*, May 1997 (Allen Paper).

a. Claims 1 and 4

It is stated that the Allen paper teaches on page 681, col. 1, 2nd – 4th paragraphs, discloses a VIV and drag suppression system consisting of providing an ultra-smooth surface about the cylinder element of ABS or PVC plastic with a k/D ratio in the range 8.86E-5 to 1.51E-4. It is stated that since the structure disclosed in the Allen paper is the same as that claimed in the [resent application, and the structure can include no other structure, the structure must inevitably perform in the same manner. Attorney respectfully traverses the rejection.

As noted in Allen Declaration 1, the tests carried out in the Allen Paper demonstrated that, without the insertion of a strongback, the PVC and ABS cylinders exhibited significant VIV and drag. The roughness R_a measured for the samples did result in a k/D ratio within the claimed range. Attorney questions the argument that the method is inherently taught by the structure. The structure taught in the Allen Paper was one in which there was no surface preparation to insure uniform smoothness. The smoothness was tested on samples that represented 0.0025% of the total surface area of each pipe. Allen Declaration 2, paragraph 8. Lacking any other surface preparation other than wiping with acetone, the PVC and ABS cylinders with samples in the claimed k/D range failed to provide VIV and drag suppression.

The only logical conclusion that can be derived is that the samples did not represent the overall smoothness of the PVC and ABS cylinders. Thus, the disclosure of the Allen paper would lead one of ordinary skill in the art to believe that the k/D ratios disclosed in therein would not suppress VIV and drag. Indeed, if it were inherent in the structure disclosed, VIV suppression would have been exhibited. Accordingly, claims 1 and 4 are patentable over the Allen Paper.

b. Claims 2 – 3 and 5 – 6

In numbered paragraph 15 of the Office Action, the Examiner rejects claims 2 – 3 and 5 – 6 as being obvious over the Allen paper in view of US 4470722 to Gregory. With respect to claims 2 and 5, it is asserted that the Allen Paper teaches all of the elements except that the ultrasmooth surface can be a coating. It is stated that Gregory '722 teaches a cylindrical housing element for use with a marine production facility that has an exterior coating of fiberglass or plastic. It posited that it would have been obvious to one of ordinary skill in the art to have modified the Allen Paper to include the ultrasmooth surface having a k/D range specified therein and applied it as a coating on a substantially cylindrical element as taught in Gregory '722. Attorney respectfully traverses the rejection.